United States Patent Application For

EXPANSION MOTOR

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What is clamed is:

1. (Amended) An external expandable holding device comprising;

a) first member having a external surface with an annular groove having protruding lips;

b) a resilient expansion sleeve is fusibly connected to the protruding lips along the edge of the annular groove; flexurally to the first member for receiving the aperture of a second member;

c) a fillet along the lip and fillister along the expansion area to further relieve stress;

d) an expansion chamber with an external leading channel is defined between the first member and the expansion sleeve for receiving fluid;

e) wherein fluid is by means pumped to pressurize expansion chamber thereby the expansion sleeve is deformed to engage the second member;

f) whereby upon release of the pressure the expansion sleeve returns to the relaxed condition to release the second member.

2. (original) The expandable device according to claim 1 wherein the holder and the expansion sleeve are cylindrical and the expansion sleeve expands radially outwardly to engage the second member.
3. (original) The expandable device according to claim 2 whereby the fluid is a liquid.
4. (omit) (Canceled)
5. (omit) (Canceled)
6. (Original)The expandable device according to claim 2 whereby the holder is a shaft, a mandrel, an arbor, a clutch, a friction brake, a coupling, a damper, or a workholder and the second part is a tool, a workpiece, a hub, or a part.
7. (Original) The expandable device according to claim 2 whereby the holder is a molded piece.
8. (Original) The expandable device according to claim 2 wherein the expansion chamber is an annular expansion chamber extending around the circumference of the holder.

9. (Original) The expandable device according to claim 8 whereby the holding device comprises of a plurality of expansion chambers arrayed longitudinally.
10. (amended) The expandable device according to claim 2 wherein the expansion chamber extends around a portion of the circumference of the holder.
11. (amended) The expandable device according to claim 2 whereby the holding device comprises of a plurality of independent expansion chambers that are axial arrayed radially.
12. (withdrawn) The expandable device according to claim 11 whereby the holding device comprises of a plurality of independent expansion chambers arrayed longitudinally:
13. (withdrawn) An internal expandable holding device comprising;

a) a first member having a bore for receiving a second member;
b) a cover to the secured to the first member;
c) an expansion chamber with rounded corners to eliminate stress concentration extends to a thin wall as defined by the bore is defined within the first member between the cover;
d) the expansion chamber is joined by a channel to an aperture;
e) furthermore to reduce stress concentrations the bore surface has filsters along the thin wall;
f) wherein fluid is by means pumped to pressurize expansion chamber thereby the first member is deformed to exert force to the second member;
g) whereby upon release of the pressure the first member returns to the relaxed condition to remove the force from the second member.

14. (withdrawn) The expandable device according to claim 13 wherein the holder and the expansion sleeve are cylindrical and the expansion sleeve expands radially inward to engage the second member.
15. (withdrawn) The expandable device according to claim 14 whereby the fluid is a liquid.
16. (withdrawn) The expandable device according to claim 14 whereby the fluid is a gas.
17. (withdrawn) The expandable device according to claim 14 whereby the external surface of the resilient expansion sleeve has special holding features.

18. (withdrawn) The expandable device according to claim 14 whereby the holder is a collet, a hub, a journal, a coupling, a clutch, a friction brake, or a workholder and the second part is a tool, a workpiece, a shaft, or a part.
19. (withdrawn) The expandable device according to claim 14 whereby the holder is a molded piece.
20. (withdrawn) The expandable device according to claim 14 wherein the expansion chamber is an annular expansion chamber extending around the holder.
21. (withdrawn) The expandable device according to claim 14 wherein the expansion chamber is an annular expansion chamber extending partially around the holder.
22. (withdrawn) The expandable device according to claim 20 whereby the holding device comprises of a plurality of expansion chambers arrayed longitudinally.
23. (withdrawn) The expandable device according to claim 20 wherein the expansion chamber extends around a portion of the bore of the holder.
24. (withdrawn) The expandable device according to claim 23 whereby the holding device comprises of a plurality of expansion chambers arrayed polar radially.
25. (withdrawn) The expandable device according to claim 12 whereby the holding device comprises of a plurality of expansion chambers arrayed longitudinally.
26. (withdrawn) An external expandable lineal actuating device comprising;

e) first member having a external surface;
f) a cover is secured to the first member;
g) an expansion chamber with rounded corners to eliminate stress concentration extending to a thin wall is defined within the first member between the cover;
h) wherein expansion chamber is joined by a channel to an aperture;
i) furthermore to reduce stress concentrations externally the thin wall is bordered with filsters;
j) wherein fluid is by means pumped to pressurize expansion chamber thereby the first member is deformed to exert force to the second member;
k) whereby upon release of the pressure the first member returns to the relaxed condition to remove the force from the second member.

27. (withdrawn) The expandable device according to claim 26 wherein the first member is a disc and the surface of the thin wall expands engage the second member.
28. (withdrawn) The expandable device according to claim 27 whereby the fluid is a liquid.

29. (withdrawn) The expandable device according to claim 27 whereby the fluid is a gas.
30. (withdrawn) The expandable device according to claim 27 whereby the external surface of the resilient expansion sleeve has special holding features.
31. (withdrawn) The expandable device according to claim 27 whereby the disc is a clamp, a support, a damper, a friction brake, a friction clutch, a jack or a workholder and the second part is a tool, a workpiece, or a part.
32. (withdrawn) The expandable device according to claim 27 whereby the holder is a molded piece.

Insert **90** and flexure end **82** to bulge **70** in direction of vector arrow ~~70~~. Stress is further relieved by groove **98** spaced around the perimeter of insert **90**. **FIG. 7a** is an example of insert **90** having a flange **92** around the inside wall **94** perimeter and a fillet **72**. **FIG. 8b** shows the motor **1** as a molded part **99**. **In FIG. 8** the width of arch cavity **76** is bound with radial by thick walls **78** and the length is by longitudinal thick walls **94**. Thereby arch cavity **76** has a bottom **80** and is surrounded by walls **76** and **94** having a flexure protrusion **82** ending with opening wall **92** along the top edge and has an inside surface **84** that is with a rounded corner **86** to thick wall **94**. **FIG. 8** shows flexure protrusion **82** ending with opening wall **92** and a rounded corner **86** to radial wall **78** and thick bottom **80**. **FIG.8a** the enlarged view from **FIG 8** showing another construction or the motor with insert **96** having flange **72** fusible joined **89** and cavity **76**.
Insert **90** is shown in **FIG. 9-11** with a plan view shown in **FIG. 9** and an orthographic view in **FIG. 10** showing a longitudinal and **FIG. 11** showing a radial section.

Yet another configuration of the motor **1** according to the invention is demonstrated in **FIG. 12-15** is having motor **1** configuration arrayed plural radial around the body **102**. The force vectors **74** radiate approximately perpendicular to the center axis **100**.

Another configuration of the motor **1** according to the invention is demonstrated in **FIG. 14-16** is having a motor body **110** and thick arch sections **112**. In **FIG. 16** it is seen that main body has annular groove **114** with rounded corner **118** to relieve stress concentration with a remaining thin wall **122**. Groove **114** partially filled with arch sections **112** and all joint fused **52** resulting in cavity **116**. To further relieve stress annular inside groove **120** is grooved in inside wall **124**. When cavity **116** is pressurized thin wall is expanded **118** in direction of vector arrow. **FIG.16a** further demonstrates this with the enlarged view

In **FIG. 17-19** another configuration of the motor **1** is shown in **FIG. 17** with congruent plug **158** joined fuse **162** to body **156**. In **FIG.18** thin wall **164** is deflected to bulge **150** in the direction shown by vector arrow **152**. Motor **1** has a main body **156** and an opening **161** sxtending to a thin wall **164** with a stress relief groove **160** spaced from around the

outer perimeter of thin wall **152**. It is shown that congruent plug **158** extends into opening **161** providing cavity **170**. Thin wall **152** is bound with round corners **166** to further eliminate stresses. **FIG. 19a** is an enlarged view showing thin wall **164** bulged with stress taken by rounded corner **166** and groove **160**.

in whereby expansion is area **150** in direction shown by vector arrow **152**. Motor **1** has a main body **156** and a cavity **158** extending to a thin wall 152 with a stress relief groove **160** spaced from around the perimeter of local area **152**. In **FIG. 18** it is shown that cavity **158** to a depth to provide for a thin wall **152** with fillet corners **166** further eliminate stresses. A congruent plug ~~168~~ 158 which provides space for cavity **170** is joined with a fusible alloy **89**.

Yet another configuration of the motor **1** according to the invention is demonstrated in **FIG. 20-21** is having motor **1** configuration arrayed plural radial around the body. The force vectors **152** converge approximately perpendicular to the center axis **100**.

Another configuration of motor **1** shown in **FIG. 22-24** according to the invention is taught in **FIG.22** whereby expansion **170** is achieved in direction of vector arrow **180**. **FIG. 23** shows body **168** with congruent plug **172** fused to body **168**. In **FIG.24** opening **174** extends to thin wall **176** with congruent plug **172** providing for cavity **178**. When cavity **178** has pressure thin wall **176** has bulge **170** in direction of vector arrow **180**. **FIG. 24a** shows thin wall **176** bulge with stress taken with round corner **182** and groove **185** spaced around thin wall **176**.

The present invention may, of course, be carried out in other specific ways other than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive and all changes coming within the meaning and equivalency range of the append claims are intended to embraced therein.